selection experiments performed with mice and demonstrating the genetic control of the size and shape of spermatozoan organelles. Additional evidence of gene expression in spermatogonial cells and in primary spermatocytes abounds while the question of haploid genome expression in spermatids pervades the entire proceedings without clear resolution. Immunological studies demonstrate the presence of antigens of the major histocompatibility loci on the surface of murine and human sperm yet provide no evidence for post-segregational gene expression. Furthermore, mouse spermatozoa with unbalanced genomic constitutions participate in fertilization in proportion to the frequency with which they are expected to be produced. In fact, the classic case of non-Mendelian recovery of the T-locus alleles in the mouse appears to be the only well-documented instance of haploid genome expression in mammals.

The level of sophistication which can be achieved with *Drosophila* is illustrated by the observation that sperm devoid of any portion of the entire genome are functional. The symposium proceedings include detailed accounts of the effects of SD (segregation distorter), an autosomal locus which condemns to degeneration spermatids containing the sensitive homologous autosome. RD (recovery disrupter), an X-chromosome locus causing fragmentation of the Y and a concomitant reduction in recovery of Y-bearing sperm, is discussed. The classic case of meiotic drive of the Bar-of-Stone translocation is reexamined. An intriguing hypothesis postulating X-chromosome inactivation during spermatogenesis is developed.

Among the numerous informative references to human material contained in the volume, the most gratifying report is that of the recognition of X- and Y-bearing sperm by the absence or presence of bright fluorescing spots within the head region.

Finally, the time-honored concern with the interaction of genotype and internal environment is evident throughout the proceedings and constitutes the central theme of some of the papers. This should extend the readership of the volume to include endocrinologists and physiologists in general.

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Radiation Biology

The Effects of Irradiation on the Skeleton. JANET M. VAUGHAN. Clarendon (Oxford University Press), New York, 1973. xvi, 298 pp., illus. $29.50.

"Be well informed but always leave room for doubt" is how Vaughan begins her comprehensive review of the human and animal data now available for the determination of safe levels of radiation exposure to the skeleton.

With two-thirds of her references taken from 1962–72, she evaluates the data pertaining to external radiation: natural levels at Edinburgh, Dundee, and Aberdeen, man-made radiation at Hiroshima and Nagasaki, x-radiation exposure of radiologists and fetuses, and so on. It was Court Brown and Doll's data on ankylosing spondylitis that were, "to a large extent, the reason for the decision of the International Commission on Radiological Protection to accept a linear relationship between radiation dose and radiation malignancy as a working hypothesis. . . ." Vaughan carefully describes the pathology of skeletal tumors in relation to what is known of their cell of origin. In evaluating the effects of internal radiation, she focuses upon radium, strontium, and plutonium.

To the discussion of these data Vaughan brings wide experience both in pathology and in animal experiments with bone-seeking radioisotopes. Concerning external radiation to man she says "the large scale surveys of populations . . . have had a relatively short follow-up period so it is possible that only the myeloid leukemias have been fully recognized." She warns against using dose-response data from mice, particularly from CF1 mice "with a known bone dyscrasia and an endemic virus," to establish radiation protection standards. The human radium cases are of "extreme scientific importance." They show an "unusually high incidence of fibrosarcoma." "The data are still reconcilable with the threshold hypothesis," but before accepting such a threshold "it would appear wise to wait until all the patients . . . have lived their full life span."

Degenerative changes or gross skeletal damage has not been seen at the lower doses still capable of inducing cancer. "The most hopeful approach to an experimental determination of low-level risks must lie in attempting to understand the mechanisms by which radiation induces malignant transformation."

Plutonium is "probably the main hazard facing the modern world." "The present maximum permissible body burden of Pu^{239} . . . may well prove too high." Plutonium "gains access to the body of man most commonly from wounds or inhalation but may be absorbed from the gastrointestinal tract particularly in very young animals." A bone-surface seeker, plutonium bombards directly the osteogenic tissue, the bone cells which are at carcinogenic risk because of their proliferative potential. Plutonium may also accumulate in bone marrow so that malignant blood dyscrasia of great importance from the point of view of radiation hazards might be expected.

Vaughan asks, "How far can the relative biological efficiency (RBE) of a radionuclide in a young dog be used to estimate RBE in an adult man when the pattern of trabeculation and rate of bone turnover varies with both species and age?" The last of 11 conclusions in this excellent monograph is that determination of doses to the sensitive tissues in different species and in man should make it possible to extrapolate radiation toxicity in animals to man with more confidence than when average dose to bone is used.

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Books Received

Adolescence and Youth. Psychological Development in a Changing World. John Janeway Conger. Harper and Row, New York, 1973. xviii, 574 pp., illus. $10.95.

Advances in Behavior Therapy. Vol. 4. Proceedings of a conference, Washington, D.C., Sept. 1971. Richard D. Rubin, J. Paul Brady, and John D. Henderson. Academic Press, New York, 1973. xviii, 304 pp., illus. $16.

Advances in Geophysics. Vol. 16. H. E. Landsberg and J. Van Mieghem, Eds. Academic Press, New York, 1973. viii, 438 pp., illus. $32.

Advances in Raman Spectroscopy. Vol. 1. Proceedings of a conference, Reims, France, Sept. 1972. J. P. Mathieu, Ed. Heyden, New York, 1973. xiv, 640 pp., illus. $44.

Agromyzidae (Diptera) of Economic Importance. Kenneth A. Spencer. Junk, The Hague, 1973. xii, 418 pp., illus. 110 Dutch guilders. Series Entomologica, vol. 9.

Aims, Methods and Assessment in Advanced Science Education. D. E. Billing

(Continued on page 852)